

The Forgotten Forefather: Joseph James Kinyoun and the Founding of the National Institutes of Health

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ABSTRACT In celebrating the 125th anniversary of the National Institutes of Health (NIH) in August 2012, NIH has been examining its origins, its history, and the visionary men and women whose research have contributed to the saving and/or improving the quality of life of millions of people throughout the world. This minireview examines Joseph James Kinyoun (1860 to 1919), the 1887 founder of a federal Hygienic Laboratory that is considered the direct ancestor of the modern NIH, and explores the development of NIH as it was shaped by, and in turn shaped, the new field of microbiology.

The twenty-seven Institutes and Centers of the U.S. National Institutes of Health (NIH) constitute one of the world's pre-eminent medical research organizations, responsible for the conduct and support of basic and clinical research that has resulted in saving and/or improving the quality of life for millions of people throughout the world. As NIH approaches its 125th anniversary (27 August 2012), we feel that it would be of interest to consider the circumstances of its origins, i.e., how it evolved from a one-person, one-room "Hygienic Laboratory" in 1887 to the transforming federal agency it is today. Despite substantial historical documentation since 1930, the year that it was named National Institutes of Health (1-6), its earlier history is less well-known. This article places Joseph James Kinyoun (1860 to 1919) and the Hygienic Laboratory in the context of important breakthroughs in microbiology at the end of the 19th century and examines the motives, beliefs, intentions, and actions of Kinyoun and his scientific contemporaries who conceived of and laid the foundations for the NIH, and whose accomplishments represented the first steps in its history (7).

(Part of the information contained in this article was presented at annual meetings of the American Epidemiological Society [26 March 2009 and 29 March 2012] and the American Society of Tropical Medicine and Hygiene [19 November 2009].)

BACKGROUND

In 1870, the U.S. Congress established the Marine-Hospital Service (MHS) which, since 1798, had been evolving from legislation that mandated medical care for ill sailors (1-3). Preventing the introduction of epidemics to American shores at international ports was a national priority that changed dramatically after 1876, when the newly established field of microbiology began to reveal the long-obscure etiologies of many important diseases: malaria and typhoid fever (1880), tuberculosis (1882), cholera, diphtheria, tetanus, and pneumococcal pneumonia (1884), and botulism and plague, as well as the first "filter-passing agents," including viruses (1894). Vaccines, passive immunotherapy, and specific antimicrobial therapies were developed rapidly, while clinical diagnosis, communicable disease epidemiology, and public health activities, including quarantine, were placed upon a solid biological basis (2, 6, 7). The last quarter of the 19th century saw the most sweeping of all medical revolutions.

KINYOUN'S EARLY YEARS

Around 1877, when there were few microbiologists anywhere in the world, a 16-year-old boy from Missouri, Joe Kinyoun (pronounced so that it rhymes with "pinion"; other relatives spell it "Kenyon") began to study medicine with his physician father, a general practitioner. Joe had been born in North Carolina hill country. His father, John Hendricks Kinyoun, and mother, Bettie Ann Conrad Kinyoun, may both have been part Cherokee (6, 8). Kinyoun's paternal great-grandfather, born near London, England, in 1756, had immigrated to the United States just after the Revolutionary War began, enlisted under General George Washington, and eventually became Assistant Quartermaster in the Continental Army (9).

Shortly after the 1860 birth of his son Joseph, in East Bend, North Carolina, John Hendricks Kinyoun left to join the Confederate Army in the Civil War (8). During his 4 years away, he wrote dreamy letters to his wife, longing for the conflict to be over, to see "little Joe," and to hear him talk. After the war, the family moved to what was then the Western frontier, settling in 1866 in Post Oak Township, south of the newly established town of Centre View (Centerview), Missouri, a year after the railroad had arrived (9). Despite living in a primitive log cabin (8), the Kinyouns seem to have been progressive, scholarly, ambitious, independent, and restless. A public school student, Kinyoun got additional training under a "preceptor," and, by age 14, was studying algebra, geometry, the Greek and Roman classics, and was conversing in French, German, and Spanish (6, 10).

When he was 16 years old, Kinyoun passed up college to learn medicine under his father, took a lecture course at the 2-year-old Saint Louis College of Physicians and Surgeons (1880 to 1881), and then moved on to New York's Bellevue Hospital Medical College (1881 to 1882) (11), one of the few American medical schools offering a solid research experience. At Bellevue, Kinyoun met several other students, house officers, and instructors who would soon join him as leaders in the nascent fields of American micro-

Published 26 June 2012

Citation Morens DM, Fauci AS. 2012. The forgotten forefather: Joseph James Kinyoun and the founding of the National Institutes of Health. *mBio* 3(4):e00139-12. doi:10.1128/mBio.00139-12.

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biology and infectious diseases. Among them were William Henry Welch, Charles V. Chapin, and Hermann M. Biggs. After graduating in 1882, Kinyoun took postgraduate courses and practiced medicine for a few months in New York City. The loss of his first patient—a little girl who probably died of diphtheria, then among the deadliest of childhood diseases—so depressed him that he considered quitting medicine altogether. Instead, he taught with his father in the Centre View Academy school while assisting him in his medical practice. Kinyoun made house calls for mostly minor medical complaints, seeing children and pregnant women (\$1 a visit and \$10 a delivery) (12). In 1883, he married a local beauty, Susan Elizabeth (“Lizzie”) Perry, the granddaughter of prominent Missouri pioneers. Their first child, Bettie, was born a year later. Subsequently, they had four more children.

Within 2 years, Kinyoun taught himself histology, pathology, and bacteriology by studying farm animal diseases like anthrax, “fowl cholera,” and “swine plague” (10), and later human erysipelas and osteomyelitis, making him the only autodidact of the tiny group of American founders of microbiology. At age 24, Kinyoun was ready to move on. Philanthropist Andrew Carnegie had just funded a laboratory for pathological and bacteriologic research at Bellevue Hospital, to be run by two of Kinyoun’s former professors. Although apparently still lacking in bacteriologic experience (13), the 26-year-old Biggs, Kinyoun’s medical school colleague, was the new instructor of one of the nation’s first academic bacteriology laboratories. As its first student (14), Kinyoun came specifically to study cholera (10), the cause of which had, arguably, just been discovered by Robert Koch (15).

THE MARINE HOSPITAL SERVICE

Since neither the MHS nor any other federal agency had a human health-oriented bacteriology laboratory at the time, it is unclear what motivated Kinyoun’s subsequent move to the MHS. In 1885 to 1886, MHS Surgeon General John B. Hamilton was building up the MHS and trying to favorably position it over another government medical organization, the National Board of Health, in a bid to make the MHS the nation’s premier public health agency (2, 16, 17). Hamilton’s right-hand man in these efforts was Kinyoun’s uncle, MHS Surgeon Preston Heath Bailhache (18), friend of the late President Lincoln and physician to the Lincoln children. Hamilton likely saw the new discipline of bacteriology as a way to advance the Service’s prospects and to support quarantine decisions. Cholera was among Hamilton’s top priorities: he had just cowritten a book on the subject that stressed the importance of “bacterioscop[ic]” diagnosis, and of essential laboratory equipment and bacterial isolation techniques (19).

For good luck, Kinyoun brought a rabbit’s foot to his 5 April 1886 MHS qualifying exam, and was later quoted as claiming that it helped him score “at the head of [his] class of seven or eight” (20) (MHS records document a score of 73.6%, barely a passing grade [10]). Kinyoun remained on a waiting list for MHS vacancies. When an MHS position became available a few months later, he took it.

THE HYGIENIC LABORATORY

With the United States threatened by potential importation of cholera from arriving ship passengers, Kinyoun entered the MHS on 4 October 1886 (10, 21, 22) (Fig. 1) at New York’s Staten Island quarantine station, the most likely port of entry for European infectious diseases. The station, with its hospital newly rented



FIG 1 Joseph James Kinyoun in Marine-Hospital Service uniform around the time of his 1886 entry on active duty in the Marine-Hospital Service (photograph courtesy of Joseph Kinyoun Houts, Jr.).

from the Marine Society, had just been relocated to allow construction of the Statue of Liberty (23, 24) on Bedlow (Bedloe) Island. Hamilton quickly set up one of the nation’s first federal bacteriology laboratories in a tiny museum room (Fig. 2) and placed the 25-year-old newcomer in charge of it (2, 25). Kinyoun opened up shop on 27 August 1887 (2, 6)—the unofficial beginning of what decades later would be known, after several relocations, as the NIH.

Kinyoun’s 16-year MHS career paralleled the emergence and growth of microbiology and epidemiology in America and of an MHS-influenced expansion of national public health activities. The Hygienic Laboratory began as a diagnostic laboratory supporting quarantine activities against the four epidemic diseases that were subject at the time to quarantine: cholera, plague, smallpox, and yellow fever. Especially during the warm-weather “quarantine season,” American consular offices around the world would cable the MHS about outbound ships that might harbor these diseases or that had left ports experiencing ongoing epidemics. MHS officers in U.S. ports would then meet and inspect the ships, examine patients, conduct epidemiological investigations, and, if necessary, fumigate the ship, cargo, and ballast while disinfecting and isolating ill and well passengers, clothing, possessions, and mail being carried (26).

Kinyoun had barely set up the Hygienic Laboratory when two Italian ships arrived in late September 1887, reporting numerous suspected cholera deaths en route (27–33). Kinyoun’s patient cul-



FIG 2 The original MHS (Marine-Hospital Service) Hygienic Laboratory on the first floor of the main building of the rented Marine Hospital, Stapleton, Staten Island, New York. The image is undated but is presumably from 1887 to 1891. The building is still standing but is unoccupied. The actual location of this room, in one of eight similar rooms on the ground floor of the central building, is not currently known. The two men in the picture have not been identified but neither appears to be Kinyoun or any of the other MHS officers known to have played an early role in the Laboratory (photograph courtesy of the National Institutes of Health).

tures grew cholera vibrios. Within days, Kinyoun and MHS officer Samuel Treat Armstrong reported the sensational news of the first bacterial detection of cholera in the Western Hemisphere (34). The MHS soon overtook the National Board of Health to survive as the nation's sole public health agency (1). As these events were unfolding, Kinyoun's 3 year-old daughter Bettie contracted and died of diphtheria (14), the same disease that had previously brought him close to quitting the practice of medicine. Bettie's death was a tragedy from which Kinyoun never fully recovered. He poured himself into work, moving quickly to begin studying other important infectious diseases unrelated to quarantine.

From 1887 until he stepped down as director of the Hygienic Laboratory 12 years later, Kinyoun pushed himself and the laboratory forward rapidly as microbiology breakthroughs (mostly from Europe) created ever more basic and applied research opportunities. In 1888, Kinyoun's first MHS protégé, Henry Downes Geddings, began running a spin-off yellow fever laboratory in Florida's Dry Tortugas (35, 36); simultaneously, the New Orleans quarantine station was reorganized according to Kinyoun's recommendations (37), setting the stage for important laboratory-supported yellow fever studies over the next decade. When in 1890 Robert Koch announced that tuberculin could cure tuberculosis (38), Kinyoun went to Berlin, Germany, as a visiting scientist to conduct a series of laboratory- and hospital-based experiments under Koch's supervision, simultaneously directing Geddings in parallel studies back at the Hygienic Laboratory and in American hospitals (38-41). Kinyoun was among the first to conclude that tuberculin was not curative (42, 43); he nonetheless retained Koch's friendship. From Berlin, he continued on to Paris, France, to work in Louis Pasteur's laboratory, learning, among other things, to produce rabies vaccine (44). Kinyoun also learned the nascent principles of the new field of immunology from Kitasato Shibasaburō, from a fellow visiting scientist, Cambridge's Ernest

Hanbury Hankin (both in Berlin), and from Paris-based Ilya Metchnikov (39).

Kinyoun brought reagents, techniques, protocols, and ideas back to the United States and turned the Hygienic Laboratory, which had relocated to Washington, DC, in 1891, into a modern European-style laboratory oriented toward both applied public health research and support of continuously occurring MHS outbreak investigations. Kinyoun invented and patented multiple industrial disinfecting machines used in quarantine operations, and experimented with temperature and pressure variables in them (45, 46). He returned to Berlin and Paris in 1894 and was one of the first Americans to study the just-identified plague bacillus (47).

In this setting, he witnessed a sensational therapeutic breakthrough that must have had great personal significance: diphtheria antitoxin (48), the first passive immunotherapy. On the hospital wards, in the laboratory, and pouring over clinical and epidemiological information, the stunned Kinyoun admitted that "I have tried to find fault, to pick flaws in the statistics, but have signally failed. The work must stand for itself. . . [it] has opened up a whole new field in infectious diseases" (49). Perhaps remembering the death of his daughter Bettie, Kinyoun was even moved to utter perhaps the least guarded response yet found in his scientific writings and speeches, describing the equine antiserum's life-saving effect on dying children as "so astounding that at first one is almost compelled to ask one's self 'is this possible?'" (48, 49). After returning home, Kinyoun set about training specialists from around the nation in diphtheria diagnosis and treatment while producing and distributing diphtheria antitoxin and other new biological agents (50-53). To save as many children as possible, he also set up—at great personal expense—a public diphtheria laboratory at Georgetown University in Washington, DC (37).

Kinyoun maintained a vigorous, multifaceted research pro-

gram at the Hygienic Laboratory: he developed the first smallpox immune serum and tested it in a clinical trial (54), was among the earliest to develop an experimental pneumococcal vaccine and an immune serum (55–57), worked on a streptococcal vaccine, studied bacterial carriage and transmission by well carriers, advocated for nosocomial infection control (58), conducted important yellow fever research, and studied the new technique of Roentgenology (radiology [59, 60]). In his spare time, he earned a Ph.D. from Georgetown University in 1896 (61). At the request of the U.S. House of Representatives, Kinyoun investigated the poor ventilation of House chambers and suggested cost-effective renovations (62). In the early 1890s, Kinyoun befriended future Army researcher Walter Reed, who became a colleague and confidant. When Teddy Roosevelt and the Rough Riders came back from the Spanish-American war, Kinyoun put them under quarantine for dysentery and malaria in Camp Wickoff, Long Island (63).

Kinyoun had long believed the Hygienic Laboratory “should form the nucleus of one national in its character,” taking on and even eradicating diseases (58, 64, 65). His 1897 summary of the Laboratory’s first decade boldly proposed that beyond studying infectious diseases during epidemics, the federal government should create a laboratory-centered international research agency to “[look] into the nature, origin, and prevention of contagious epidemics, and other diseases affecting the people, and should also make investigations into other matters relating to public health” (65).

PLAGUE IN SAN FRANCISCO

On 27 April 1899, MHS Surgeon General Walter Wyman abruptly transferred Kinyoun to run the quarantine station in San Francisco, California. Plague—the most feared of all pandemic diseases—had been spreading globally for several years and was undoubtedly headed for U.S. ports, notably San Francisco, which received heavy ship traffic from Asian cities with ongoing epidemics. Having long predicted its inevitable U.S. arrival, Kinyoun had begun a plague research program in 1896 (49, 66). Sending his top scientist to the front lines may have appeared necessary to Wyman who, like Kinyoun, believed that only vigilant quarantine would keep plague out.

The events that unfolded in San Francisco in 1899 to 1901 represent one of the most infamous chapters in U.S. public health history (67–105). Kinyoun’s arrival to prevent disease importation by “plague ships” bound from Asia (106) ignited a long-simmering “state’s rights” feud between California and the federal government (107). Legislation enacted in 1893 had authorized the MHS to work cooperatively with local quarantine officials (108, 109). Wyman’s order to “pay no attention to” California’s quarantine officials put Kinyoun squarely at odds with combative California Governor Henry Tift Gage, who now threatened MHS officials with lawsuits and armed force (2, 96).

Under federal orders, Kinyoun began quarantining all arriving vessels from the four current “plague ports”—Honolulu, Hawaii, Sydney, Australia, Hong Kong, China, and Kobe, Japan—and simultaneously supported San Francisco’s Board of Health in “cleaning up” Chinatown by trash removal, rodenticidal fumigation of sewers, and whitewashing and disinfection of homes. A plague case in San Francisco on 6 March 1900, confirmed by Kinyoun as the first ever on U.S. soil (110–134), caused near hysteria nationwide. San Francisco’s mayor and Board of Health immediately placed Chinatown within a police *cordon sanitaire* but then

backed off in the face of legal challenges by a Chinese cultural association allied with California businessmen and politicians. Governor Gage declared plague to be a ruse concocted by Kinyoun and the Board of Health to blackmail the city for public health funds (87, 110, 135). In the California legislature, it was suggested that Kinyoun be hanged (136). As plague cases mounted, control efforts and house-to-house inspections and treatments were thwarted by residents, especially the Chinese, who understandably resented being discriminated against.

On 16 May 1900, with 11 indigenous Chinatown plague cases already confirmed and with many more hidden cases suspected, Kinyoun, at Wyman’s instruction and with Board of Health support, declared an epidemic (77, 80, 81, 86, 87, 91). President McKinley authorized implementation of 1893 interstate quarantine provisions requiring unvaccinated Chinese and Japanese persons within the epidemic zone to provide health certificates for interstate travel. Enraged MHS opponents took out a \$7,000 contract on Kinyoun’s life (family records specify that it was \$50,000), forcing him to carry a loaded revolver and have an escape launch at the ready (14, 137, 138). The city of San Francisco assigned 100 policemen to protect him; at one point, the U.S. Army was called in for the same purpose. During the worst of it, Kinyoun traveled anonymously, checking into hotels under the name of “Kenar” (139). Chinatown residents got a restraining order in federal district court and brought suit against him for ostensibly overstepping federal orders (140). Realizing that Kinyoun was being made a scapegoat, Bailhache advised him to get outside counsel (141). He did not do so but eventually was exonerated.

Listening to the suggestion of their old friend William Welch, Surgeon General Wyman called in an outside commission of national bacteriology experts to investigate the alleged “plague fake.” The experts were Simon Flexner (University of Pennsylvania), Lewellys F. Barker (University of Chicago), and Frederick G. Novy (University of Michigan). When the commission fully confirmed Kinyoun’s findings (142–144), Governor Gage and California politicians suppressed the report. The McKinley administration countered by threatening to close Army headquarters in San Francisco and divert arriving Philippine transports to Puget Sound, thereby depriving California of revenue (145–147). The standoff was resolved in the office of President McKinley: California would let the MHS take over plague control and quarantine if the MHS removed Kinyoun from his post and if California did not have to admit that he and the MHS had been right about plague all along. After the deal, Governor Gage kept his part of the bargain by admitting a plague epidemic; however, he now accused Kinyoun of having started it by planting plague bacilli on cadavers (132, 148). Railing against the importation of what are now called “select agents” used for “bioterrorism” (132), Gage guided the passage of among the first antibioterrorism laws enacted anywhere.

Although Kinyoun’s private correspondence reveals tremendous stress at being forced into the role of scapegoat and villain, he never exposed the many instances of questionable, unethical, or illegal practices he witnessed, which included attempts to bribe him. Empathizing with the widow in Goethe’s *Faust* (149), Kinyoun seems to have imagined Mephisto’s musing about her. “I wonder where she is going when she dies,” he joked (141). “I wont [sic] have her. She knows too much.”

In an irony that must have seemed bewildering to him, on the day of Kinyoun’s arranged departure from San Francisco, his public notoriety brought one last tribulation: a charge of attempted

murder. A deaf-mute fisherman claimed that Kinyoun had directed riflemen to shoot him as he drifted offshore. Kinyoun's release was only secured by Army testimony that it had been soldiers chasing an escaped prisoner who had fired warning shots at the fisherman, a suspected get away accomplice, and that Kinyoun actually had intervened to protect him (150-152). Free of courts, jails, and the San Francisco press, Kinyoun left on an Asian trip on 17 July 1901 to investigate plague epidemics and visit his old Berlin friend Kitasato Shibasaburō, now in Japan. On his way back, he stopped in the Philippines and codiscovered surra, a new equine disease associated with the previously identified *Trypanosoma evansi* (153, 154).

It had been Kinyoun's desire to stay in the MHS, finish the work in San Francisco, and achieve vindication. He now felt that honor compelled him to resign. On 1 May 1902, Kinyoun became a private citizen. It was—briefly—national news. In parting comments to Bailhache, Kinyoun reflected that “it was through my efforts that the Hygienic laboratory was established. My fifteen years of work stand for this, and I believe that I can point to it with a little . . . pride. . . There is one thing [no one in] the Marine Hospital Service can take from me, and that is my professional standing and character” (107). A colleague noted that Kinyoun “was more proud of and devoted to” the Hygienic Laboratory than anything else (155). Perhaps remembering the long series of outrageous events over the preceding year in San Francisco, he hid his disappointment behind levity: “It was really a tragic occurrence,” Kinyoun mused, “but all tragedies are tempered with comedy” (107).

LIFE AFTER THE MHS

Some of Kinyoun's most important undertakings began to bear fruit just as he left the MHS. On 1 July 1902, Congress expanded the MHS and renamed it the Public Health and Marine-Hospital Service (later the Public Health Service) and specifically authorized and expanded the Hygienic Laboratory (156). On the same day, Congress also passed legislation requiring the standardization of, and federal quality control over, biological products such as immune sera and vaccines (157), an act that led to important Hygienic Laboratory work, which was later transferred to the Food and Drug Administration (FDA). Ironically, Kinyoun had drafted the first of these acts (64) and had been a moving force behind the second (21), reflecting two of his greatest passions.

By 1904, 121 cases of plague—113 of them fatal—had been diagnosed in San Francisco, and health officials believed many more had been concealed. Epidemic plague returned after the 1906 San Francisco earthquake to claim even more lives, and the plague bacterium moved into ground squirrels and prairie dogs to establish an American reservoir which remains, 112 years later, a continuing public health threat in many Western states. Bailhache urged Kinyoun to write a book about his San Francisco experiences. Despite privately penning at least two detail-rich documents about it (107, 141), Kinyoun apparently went only so far as to suggest that if he did write such a book, he would title it after Victor Hugo's 1862 novel *Les Misérables* (“the unfortunate ones”), calling it *Les Misérables en Quarantaine* (141).

After leaving the MHS, Kinyoun joined one of the two major pharmaceutical firms then in existence: H. K. Mulford Laboratories in Glenolden, Pennsylvania (now Merck, Sharp and Dohme [158]). Four years later, he returned to the District of Columbia to direct its Health Department Bacteriology Laboratory (159). Over

the next decade, he quietly worked on problems such as water quality, bacillary dysentery, and hookworm disease. He developed a safer and more reliable smallpox vaccination technique (the “Kinyoun method” of rolling a needle parallel to the skin) used widely, with Public Health Service endorsement, until development of the bifurcated needle in the 1960s (160-162). He also perfected a stain for *Mycobacterium tuberculosis* and other organisms (the Kinyoun stain [163]) that is still used today. He repeatedly stressed the importance of emerging zoonotic diseases (58, 164), argued for better notification of infectious diseases as a means of disease control, and even predicted organ transplantation (165). He became increasingly involved in progressive community health issues, such as basic sanitation and hygiene, tuberculosis control, water safety, meat safety, bread quality, and milk sanitation (166, 167).

As an elder statesman, he served energetically in many national professional societies, e.g., as vice president of the American Society of Tropical Medicine [and Hygiene] during its first full year of existence (1904) (168) and as first vice president of the American Public Health Association (1906). He had been a prominent leader in the 1894 Convention of [American] Bacteriologists (169, 170), which brought the profession together for the first time, and in 1909, he became president of the Society of American Bacteriologists (now the American Society for Microbiology). In his Presidential Address, he discussed the new/evolving idea of two compartments of immunity, natural and acquired (171). In 1916, Kinyoun took a 3-month leave of absence to become director of the Health Department in Winston-Salem, North Carolina, and thoroughly reorganized it (172).

These years appear to have been happy times spent with his family, out of the national spotlight. He and Lizzie were active in Washington's Temple Baptist Church. Like his father and other male relatives, Kinyoun was a Mason and attended Washington's Benjamin Brown French Lodge no. 15. At home he wrote fanciful stories and verse. For a time he raised two chow dogs—then an exotic breed in America—ostensibly to save them from ending up on the menu at a Chinese banquet (173). A 1910 *New York Times* article attributes to Kinyoun an elaborate theory that ear shape determines musical ability (174). Several newspapers described an even more bizarre event. All her life, Lizzie Kinyoun had longed to see her own mother, who had died shortly after childbirth. Nearly 30 years later, she traveled to Centre View (it is unclear whether her husband accompanied her) and had her mother's “hermetically sealed” metallic casket disinterred and opened. According to *The [Baltimore] Sun*, Lizzie gazed upon the face of a beautiful young woman who appeared to be still alive (175).

Speaking candidly about the Hygienic Laboratory in 1906, Kinyoun articulated a vision for the future of national public health that echoed notions of men such as John Hamilton who had come to prominence in the 1870s. Kinyoun had long spoken in favor of dramatic expansion of the MHS into a powerful national organization taking on all human diseases and trying to eradicate those that could be eradicated (2, 65). In 1906, Kinyoun again argued for a “national sanitary organization” with a strong research-oriented laboratory core that would not only conduct its own research but also assist the states in research, outbreak investigation, apparently also control and standardization of biological products, and prevention and eradication of diseases, in essence, a powerful national organization that would combine the separate functions of what later would become the FDA, NIH, and U.S.

Centers for Disease Control and Prevention (64). In a similar 1910 proposal for a national health department to be directed by a cabinet-level secretary (S. 6049), Oklahoma Senator Robert L. Owen remembered the San Francisco plague events in a speech on the U.S. Senate floor (176–178). Owen emphasized the need for a national health organization by lauding Kinyoun and the other public health officials who had been on the front lines a decade earlier.

THE END OF AN ERA

By 1917, when the United States entered the Great War, Kinyoun had been largely forgotten by the public, but his coinvented “Kinyoun portable bed disinfectors” (for bedding, clothing, and dressings) were still being used for sterilization and for killing lice in quickly built Army hospitals (179). Always proudly patriotic, Kinyoun now sought to join the Army. At age 57, he was given an active duty commission (unusual for someone that age) as an Expert Epidemiologist assigned to the cantonments in North and South Carolina. Perhaps an old Bellevue colleague, now Army Surgeon General William Crawford Gorgas, had pulled strings. Nurturing a lifelong love of the region of his birth, Kinyoun investigated North Carolina’s state-wide typhoid epidemics, directly under Gorgas and one of his senior staff officers, another old bacteriologist friend, Colonel Victor C. Vaughan (180). Four months after deployment, Kinyoun found a lump in his neck. A biopsy specimen revealed an inoperable lymphosarcoma. Vaughan helped him circumvent Army regulations to get top civilian care; Welch, now also on active duty as an Army Brigadier-General, may have helped arrange his treatment at Johns Hopkins Hospital.

Kinyoun still carried the old rabbit’s foot, but it no longer brought luck. On 15 August 1918, Kinyoun drafted both a will and a letter of instruction to Lizzie that upon his death he be buried with their daughter Bettie, who had died of diphtheria—by now both a vaccine-preventable and serum-curable disease—30 years earlier. As his health declined, Kinyoun, apparently as a result of the influence of Army medical friends, was reassigned on 6 December 1918 as a pathologist to Washington’s Army Medical Museum, where his late friend Walter Reed had been curator; and finally, one day before his death, to Surgeon General Gorgas’ office. With Lizzie at his side, and with his surgeon, Army Captain George C. Smith, in attendance, Kinyoun died at home of “myocardial insufficiency” (primary death certificate diagnosis) at 4:45 p.m. on Valentine’s Day, 14 February 1919. By that time, he was forgotten by all but a few old friends and colleagues. Lizzie died in 1948, and the couple was reunited in a single Centre View gravesite with their daughter Bettie.

PERSPECTIVES

Kinyoun has long seemed an indistinct and mysterious figure in the history of American biomedical science. Was he a transformational figure himself, or merely a man in the right place at the right time whose role might just as well have been filled by another? What role did he play in the rapid expansion of American microbiology into a century of dominance? Was he a visionary who saw and brought about the future of biomedical science or an ordinary man of average skills? Would the NIH exist today without his contributions and, if so, in what form?

These are questions that may never be answered definitively. Progressive, intelligent, and optimistic, Kinyoun seems very much a man of his times who found himself at the cusp of a dramatic

new era. As is often the case with young men of energy and optimism, confronted by a wave of rapid scientific and technical advances, he was able to intuitively find a comfortable place at its leading edge. He seems to have been attuned to new technology and new ideas and able to anticipate their potential importance long before it became apparent to most others.

He appears also to have seen biomedical research primarily as a way to be a better physician and citizen. The record we have examined suggests that every step Kinyoun took in pursuing medical and public health problems, even the most rigorous of experimental research, was directed toward the immediate goal of saving lives and alleviating human suffering, and not for “mere” interest’s sake. His definition of an ideal health officer seems an apt description of Kinyoun himself: “A true physician in every sense of the word, a man of broad views, of progressive spirit. . . and a large supply of good common sense” (58). He also exhibited a talent for identifying and mentoring promising like-minded acolytes, not only Reed and Geddings, but others such as Milton J. Rosenau and John F. Anderson, both of whom succeeded him as Hygienic Laboratory Directors, William Franklin Elgin, who became a renowned pharmaceutical scientist, and two future Surgeons General, Hugh S. Cummings (Surgeon General from 1920 to 1936), who trained under Kinyoun in the 1890s, and Thomas Parran (Surgeon General from 1936 to 1948), a medical student extern in whom Kinyoun instilled the desire to join the Public Health Service (20). Perhaps Kinyoun’s most unique talent was an uncanny ability to draw insightful public health conclusions from complex technical data.

Kinyoun was born into a romantic world of frontiersmen, Native Americans, adventurers, war heroes, and old world Southern gentility; he lived to see the modern era of electricity, telephones, movies, radios, automobiles, airplanes, and noisy, hectic urban life. A Southern gentleman with old-fashioned values (even in private letters to worldly colleagues, he cursed only with “d__n” and “h__l”), Kinyoun ended up a “progressive” achieving success in a modern world that had little interest in traditional ways. It was a world of extraordinary progress and the possibility of dramatic upward mobility that could erase one’s origins. At home with memories of the old South, and with fanciful tales of antebellum plantation life (14), Kinyoun seems to have easily become a polyglot and internationalist, moving about comfortably in the capitols of Europe and Asia, readily adapting to foreign customs and ways of looking at the world. If there are paradoxes or ironies in Kinyoun’s life story, it is not clear that he recognized them.

The medical world of his childhood had been one of mysterious miasmas and vague telluric (terrestrial) influences acting upon unpredictable diseases of completely unknown causes, of amputations for bacterial infections, and of bleedings and purgings prescribed for even mild illnesses. He lived to see scientific acceptance of the germ theory, a rather obscure notion when he had been a child, and its widespread public acceptance as well. He saw the extraordinary advances in diagnosis and treatment that followed acceptance of the germ theory: not only passive immunotherapies, vaccines, antimicrobial agents, aseptic surgery, and the beginnings of vaccination against childhood diseases, but also mothers sterilizing rubber nipples by boiling them in pots of safe municipal water before placing them upon bottles of pasteurized milk.

LEGACY

Along with others of the 116,707 fallen American soldiers of the Great War, Kinyoun's name was placed within the cornerstone of the World War I Memorial on the National Mall in Washington, DC (6). A marble statue to World War I's fallen District of Columbia employees, with Kinyoun's name engraved upon it, sits usually unnoticed in a stairwell of the District's Municipal Building on Pennsylvania Avenue, not far from the White House. Kinyoun's second son, Conrad Houx Kinyoun, became a biomedical scientist who worked for a time at the NIH (181), married into the North Carolina Craighill family of renowned Rockefeller scientist Rebecca Lancefield, and eventually followed in his father's public health footsteps to become the director of the Department of Health Laboratories of Savannah, Georgia. The Liberty Ship *Joseph J. Kinyoun* (a military cargo ship) was commissioned and saw service in World War II. In 1935, Wilfred H. Kellogg, one of the nation's leading plague experts, recalled: "I remember of Dr. Kinyoun. . . there was no better bacteriologist probably in the country" (72). Kinyoun's name, Kellogg claimed "should be indelible in the annals of public health" (71). After Kinyoun's death, Lizzie and her oldest surviving daughter, Alice Eccles Kinyoun [Houts]—who had always believed that one day the stigma of San Francisco would fade and that Kinyoun would at last be fully recognized—put 75 boxes of his papers, documents, photographs, and memorabilia into storage, where those surviving have remained untouched for almost a century. They will soon be made available for scholarly examination (14).

The modern NIH was created in 1930 (2). Today it is the world's premier biomedical research organization, containing not only the core Institute that once was the Hygienic Laboratory—now called the National Institute of Allergy and Infectious Diseases (NIAID)—but 26 other Institutes and Centers that carry out Kinyoun's vision of working globally with the best scientists of the nation and world to prevent and treat virtually all human diseases. An oil portrait of Kinyoun hangs in the main administration building of NIH, the James Shannon Building (Building 1). The NIAID Kinyoun Lecture Series, established in 1979, is among the most prestigious of NIH's named lectures. Were he alive today, Kinyoun surely would be astonished and gratified to see what his efforts produced. We believe he would be far less interested in NIH's buildings, laboratories, equipment, and scientific techniques, than in what NIH and its intramural and extramurally funded scientists have done, and will do in the future, to save human lives and reduce the suffering caused by disease.

ACKNOWLEDGMENTS

We thank Daniel Lednicer and Barbara Harkins for research assistance, as well as Betty Murgolo and the staff of the NIH Library, the staff of the History of Medicine Division, National Library of Medicine, NIH, and Eva Åhrén, Laurie K. Doepel, Gregory K. Folkers, Victoria A. Harden, Hillery A. Harvey, Joseph Kinyoun Houts, Jr., and Warren Winkelstein for helpful discussions and reviews.

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